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 FLUID PUMP

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(56) Prior Art Documents
 AU 11812/66
 AU 41691/64
 AU 11978/55

(57) Claim

1. A reciprocally operable fluid pump comprising an elongate tubular barrel housing having a lower fluid intake end part and an upper fluid discharge part, the lower intake end part being provided with a one way valve means permitting passage of fluid through at least one intake opening thereat to the interior of the barrel housing but preventing egress of fluid from such intake opening(s), and an elongate pump shaft arranged for location and longitudinal reciprocal movement within said barrel housing and having an upper end part arranged to project through and beyond a seal means at the barrel housing upper end to be subject to a reciprocal driving force in operation of the pump; the pump shaft being provided at an inner lower end thereof with a hollow piston assembly having a main piston part of complementary dimensions to the barrel housing bore for sliding seal engagement therein, said main piston part incorporating a one way valve means arranged to open and close at least one lower transfer opening communicating with the interior of the main piston part and a lower chamber defined between the barrel housing intake part and valve means and the

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piston assembly; the cross sectional dimensions of the pump shaft are such that an annular chamber is defined thereabout within the barrel housing between said piston assembly and a fluid discharge outlet at or near the upper end of the barrel housing, and an upper part of said piston assembly and/or an adjacent connection with the pump shaft defines a co-axial upper extension of the main piston part interior and is provided with at least one further fluid transfer port(s) communicating with said annular chamber; and

wherein said pump shaft has its inner lower end part coupled to an upper wall part of the piston assembly and defining a lower pump shaft chamber opening to a medial fluid transfer port in said piston assembly upper wall part, said pump shaft inner lower end part being provided with at least one further fluid transfer port opening to said lower pump shaft chamber to enable fluid forced through said piston assembly, the arrangement and construction providing that with the pump intake end part immersed in a fluid and the barrel housing fixed against movement, first upward movement of the pump shaft and connected piston assembly will draw fluid into the lower chamber via said intake opening(s) and one way valve means therefor, following downward reciprocal movement of the pump shaft and piston assembly causes and permits transfers of fluid from the lower chamber to said annular chamber via said piston assembly transfer opening(s) and port(s) and one way valve means, and following upward reciprocal movement of the pump shaft and piston assembly will force the fluid in the annular chamber to be discharged through the discharge outlet simultaneous with intake of fluid to the lower chamber.

682656

PATENT REQUEST: PETTY PATENT

I, ROBERT WILLIAM LUFF, being the person identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification.

Full application details follow:-

| | |
|--|--|
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| Address: | 212 Collingwood Street, Nelson, New Zealand |
| Nominated Person: | ROBERT WILLIAM LUFF |
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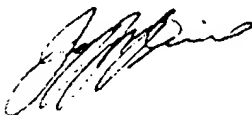
Drawing number recommended to accompany the abstract - Fig. 1.

DATED this 13th day of December 1996.

ROBERT WILLIAM LUFF

By his Patent Attorneys:

CALLINAN LAWRIE



NOTICE OF ENTITLEMENT

Insert name of
applicant

~~I/We~~ ROBERT WILLIAM LUFF
of, 212 Collingwood Street, Nelson, New Zealand
being the applicant in respect of Application No.
state the following:-

Only complete if application
filed before 30 April 1991.

The inventor(s) of the invention are as follows:

Name(s) and address(es)
of inventor(s)

Complete only for
non-PCT applications

The person(s) nominated for the grant of the patent:

- (i) is/are the actual inventor(s)
(i) ~~has/have entitlement from the actual inventor(s) by virtue of~~
- (ii) ~~is/are the applicant(s) of the basic application(s)~~
(ii) ~~has/have entitlement from the applicant(s) of the basic~~
~~application(s) listed on the patent request form by virtue of~~

Complete only for
PCT applications

~~The person(s) nominated for the grant of the patent:~~

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~~declaration under Article 8 of the PCT~~
- (i) ~~has/have entitlement from the inventor(s) and/or the~~
~~applicant(s) of the application(s) listed in the declaration~~
~~under Article 8 of the PCT by virtue of~~

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Date

COMPLETE SPECIFICATION

FOR A PETTY PATENT

ORIGINAL

TO BE COMPLETED BY APPLICANT

Name of Applicant: ROBERT WILLIAM LUFF

Actual Inventor: ROBERT WILLIAM LUFF

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Invention Title: "FLUID PUMP"

The following statement is a full description of this invention, including the best method of performing it known to me:-

FLUID PUMP

Field of Invention

This invention relates to fluid pumps and is more particularly concerned with 'lift' type reciprocating fluid pumps which are arranged to lift liquids from a lower level and discharge raised liquid at a higher level.

10 The invention is applicable to manually operable or powered reciprocating pumps and may for example be particularly applicable to (but not necessarily confined to) such as bore or well pumps; and pumps intended for extracting or discharging prescribed quantities
15 of liquids contained in such as drum or barrel containers and the like.

Prior Art

A large variety of reciprocating pumps for the indicated purpose are known and have been proposed over the years, some complicated in construction and others of relatively simple construction, and all of which operate or are operable with varying degrees efficiency. One example of a prior and quite effective reciprocating
25 fluid pump in the field to which the present invention applies is that the subject of New Zealand Patent Specification No. 206045, but such prior pump construction employs different features (including a reciprocal hollow plunger which fills with fluid)
30 and operates in a different manner to the features and manner of operation of the present invention.

Objects of Invention

An object of the present invention is to provide a relatively simply constructed, and thus economical to produce, double acting fluid pump which is effective and efficient in operation, and will provide the purchasing public with a further alternative to existing

and known pumps intended for similar purposes.

Other and more particular objects and advantages of the invention will become apparent from the ensuing description.

In accordance with the present invention, there is provided a reciprocally operable fluid pump comprising an elongate tubular barrel housing having a lower fluid intake end part and an upper fluid discharge part, the lower intake end part being provided with a one way valve means permitting passage of fluid through at least one intake opening thereat to the interior of the barrel housing but preventing egress of fluid from such intake opening(s), and an elongate pump shaft arranged for location and longitudinal reciprocal movement within said barrel housing and having an upper end part arranged to project through and beyond a seal means at the barrel housing upper end to be subject to a reciprocal driving force in operation of the pump; the pump shaft being provided at an inner lower end thereof with a hollow piston assembly having a main piston part of complementary dimensions to the barrel housing bore for sliding seal engagement therein, said main piston part incorporating a one way valve means arranged to open and close at least one lower transfer opening communicating with the interior of the main piston part and a lower chamber defined between the barrel housing intake part and valve means and the piston assembly; the cross sectional dimensions of the pump shaft are such that an annular chamber is defined thereabout within the barrel housing between said piston assembly and a fluid discharge outlet at or near the upper end of the barrel housing, and an upper part of said piston assembly and/or an adjacent connection with the pump shaft defines a co-axial upper extension of the main piston part interior and is provided with at least one further fluid transfer port(s) communicating with said annular chamber; and wherein said pump shaft has its inner lower end part coupled to an upper wall part of the piston assembly and defining a lower pump shaft chamber opening to a medial fluid transfer port in said piston assembly upper wall part, said pump shaft inner lower end part being provided with at least one further fluid ^{to be} transfer port opening to said lower pump shaft chamber to enable fluid to be forced through said piston assembly; the arrangement and construction



providing that with the pump intake end part immersed in a fluid and the barrel housing fixed against movement, first upward movement of the pump shaft and connected piston assembly will draw fluid into the lower chamber via said intake opening(s) and one way valve means therefor, following downward reciprocal movement of the pump shaft and piston assembly causes and permits transfer of fluid from the lower chamber to said annular chamber via said piston assembly transfer opening(s) and port(s) and one way valve means, and following upward reciprocal movement of the pump shaft and piston assembly will force the fluid in the annular chamber to be discharged through the discharge outlet simultaneous with intake of fluid to the lower chamber.

The Drawings

Some preferred aspects of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

FIGURE 1 is a partly diagrammatic longitudinal sectional view of a first simple form of manually operable pump in accordance with the invention, with the pump shaft and piston assembly shown in their lowermost positions.

FIGURE 2 is a similar longitudinal sectional view of the pump of figure 1, but with the pump shaft and piston assembly in a raised position.

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Description

The fluid pump of this invention can be constructed from any suitable materials applicable to the intended purposes, and as is common it is preferable that the materials utilised are corrosion resistant and that the pump is maintenance free. The pump has a minimum of working parts and is preferably arranged to utilise standard readily available componentry facilitating

manufacture and for economical manufacture.

Metals such as copper or brass, aluminium alloy or stainless steel, and/or suitable plastics materials
5 can be employed in the construction of principal components of the pump and according to the intended disposition and use of the pump - in particular according to the kinds of fluids to be pumped. In the latter regard one application of the invention
10 is for use in pumping out prescribed quantities of liquid chemicals and/or chemical solutions contained in drums, and for such uses the pumps preferably employ durable ultra violet ray and chemical corrosion resistant PVC or other plastics materials for at least
15 the principal components.

The pump is formed with an elongate cyclindrical tube body or barrel housing (generally indicated by the arrow 1) of uniform cross section about at least the
20 major part of its length, but preferably with a slightly larger diameter upper end section 2 defining an expansion chamber 2a and having a discharge outlet nozzle or conduit part 3 projecting laterally (and downwardly in the illustrated example) therefrom.

25 The upper section 2 has an upper closure 2b in the form of or provided with a central bush through which the pump shaft (generally indicated by the arrow 4) is slidably located to be disposed concentrically within
30 the barrel housing 1. A resilient liquid seal member 5 is located below the upper closure 2b and about the pump shaft 1, and above the discharge outlet 3a opening to the expansion chamber 2a. The upper outer end part 4a of the pump shaft 4 is shown in this instance with
35 a simple connected transverse handle 6 for manual operation and direct push/pull action by a user; but it will be appreciated that the required reciprocal movement of the pump shaft 4 can be alternatively

obtained by way of such as a pivotally connected lever and/or link mechanism, rotary or oscillating means with reciprocal movement conversion mechanism, or other reciprocal movement mechanism(s) - any of which may
5 be manually actuatable or arranged to be actuatable/operated by any suitable power source.

The pump lower intake end part 1a is arranged for immersion in the liquid 7 to be pumped and is provided
10 with a one-way intake valve assembly (generally indicated by the arrow 8), which in this instance is shown to be a ball valve assembly 8 having a ball 8a loosely housed within a tubular sleeve part 8b, a lower end seat 8c defining an intake opening 8d which opens
15 to the open lower end 1b of the barrel housing intake end part 1a, and an upper apertured restrainer 8e. If desired the ball 8a can be normally urged such as by a light compression spring onto its seat 8c in closing the intake opening 8d, but this is normally
20 unnecessary as seating and closure will generally take place under the weight of the ball 8a and by liquid pressure within the barrel housing 1 on downward movement of the pump shaft 4 and connected piston assembly (generally indicated by the arrow 9).

25 The piston assembly 9 comprises a piston 9a of hollow cylindrical form and the one way valve means 10 therefor can also be a ball valve, with a ball 10a loosely housed between an upper part 9b of the piston 9a and a lower
30 annulus 10b defining a central lower fluid transfer opening 10c and a valve seat 10d on which the ball 10a locates to close such opening; the annulus 10b may also have its outer periphery arranged to define a piston seal or be provided with one or more o-ring
35 seals so as to form a fluid tight sliding seal with the inner wall surface 1c of the barrel housing 1. Again the ball 10a can be biased toward its seat 10d if required, but this is not really necessary in most

cases. The piston upper part 9b connects to or is provided with a co-axial opening 9c and a communicating co-axial relatively short tubular extension 9d which can (as shown) be defined by the inner lower end connecting part of the pump shaft 4 when formed from tubular material - a closing plug 9e being inserted to define the short length of the extension 9d, as exemplified, or which can be an integral part of the piston assembly 9 - in which case the pump shaft 4 can, if preferred, be of solid rod form.

The outer diameter of the pump shaft 4 is significantly smaller than the bore of the barrel housing 1, so that an annular fluid receiving chamber 11 is defined between the outer surface of the pump shaft 4 and inner wall surface 1c of the barrel housing and extends longitudinally between the piston assembly 9 and expansion chamber 2a; and a plurality of fluid transfer ports or apertures 12 are provided in the piston tubular extension 9d (or lower plugged connecting part of the pump shaft 4) and/or the piston upper part 9b to thus provide (when the ball 10a is displaced off its seat 10d) communication between the upper annular chamber 11 and a lower intake chamber 13 defined within the barrel housing 1 between the intake valve assembly 10 and piston assembly 9.

Thus, in operation of the pump with the barrel housing 1 fixed in position and its lower intake end part 1a first immersed in the liquid 7 to be pumped, first upward movement of the pump shaft 4 from its innermost or lowered position (as shown in figure 1) by a user pulling upwardly on the handle 6 will create a vacuum in the lower intake chamber 13 as the piston assembly 9 rises (the ball 10a being seated to close transfer aperture 10c) to enable liquid 7 - which is under atmospheric pressure - to be drawn through the barrel housing lower end opening 1b and intake aperture 8d

past the ball 8a and through the apertured retainer 8e to fill the lower intake chamber 13 as the pump shaft 1 and piston assembly 9 move to the upper end of their stroke, as depicted in figure 2 of the drawings. The user then pushes down on the handle 6 to force the pump shaft 1 and piston assembly downwardly to create back pressure on and close the intake valve ball 8a on its seat 8c and prevent escape of the liquid 7 through the intake aperture 8d, so that the liquid 7 in the intake chamber 13 forces open the transfer valve ball 10a off its seat 10d to permit the liquid 7 in the intake chamber 13 to transfer to the upper annular chamber 11 via the transfer apertures 10c and 12 as the piston assembly 9 is moved back to its lowermost first position of figure 1. The next lift action by the user to again raise the pump shaft 1 and piston assembly 9 will cause closure of the transfer valve ball 10a onto its seat 10d and opening of the intake valve 8a off its seat 8c to simultaneously drawn into the intake chamber 13 a next charge of the liquid 7 whilst raising the liquid 7 in the annular chamber 11; whereby, in a relatively short barrel housing 1 with a pump shaft 1 of complementary length, the liquid 7 in the annular chamber 11 will be moved into the expansion chamber 2a and discharged via the outlet 3a and discharge nozzle 3. The pump will then be fully primed and continued operation will ensure a constant flow of liquid through the pump.

The barrel housing 1 can be readily made of any desired length and can thus be used for relatively deep wells or bores, deep tanks or such as boat bilge locations; and preferably the pump shaft 4 is of commensurate length to ensure that the piston assembly 9 locates and remains in the lower end part of the long barrel housing 1 so as to be immersed in the body of water or other liquid at the barrel housing intake end 1a, and thus ensure that the pump remains primed after

the first operating stroke of the pump shaft 4 and connected piston assembly 9. It is not necessary that the pump shaft 4 and piston assembly 9 be required to be moved the full length of the barrel housing 1 as for the shorter pump illustrated by way of example in the drawings, as the reciprocal operation and relatively short strokes will pump the liquid into the barrel housing 1 chambers 13 and 11 and forceably displace any air initially (on first installation) upwardly out of the upper annular chamber 11; and the non-return valve means 8 and 10, with the piston assembly 9 seal, will keep the pump fully primed with the upper chamber 11 normally filled with liquid for immediate operation as required in lifting and discharging the liquid at the upper end of the pump.

However, whilst a long pump shaft 4 is desirable for the pump to perform efficiently and effectively as indicated, in some cases an overlong pump shaft 4 may be heavy and/or difficult to install and be easily reciprocally movable eg should the barrel housing be or become curved or have a bend at a point along its length; and in such cases the pump shaft 4 is not required to be of commensurate length to necessarily have the piston assembly 9 move down close to the barrel housing intake end part 1a and the intake valve assembly 8 - and the piston assembly 9 and connected pump shaft 1 can operate in the upper part of the barrel housing 1 with a relatively short stroke. In such a pump construction however, a number of sequential initial pump shaft 1 and piston assembly strokes will necessarily be required to fully prime the pump to the stage where the upper annular chamber 11 is filled and continued operation will discharge the liquid 7 through the discharge opening 3a and nozzle 3, and more positive acting non-return valve means and piston seal means will be required to prevent air leakage permitting the liquid level in the pump chambers 11

and 12 from falling whilst the pump is not operating.

It will be appreciated that one way or non-return valves
of various kinds can be employed in place of the ball
5 valve arrangements mentioned; for example simple flap
or plate valves, poppet valves or the like can be
employed.

Other variations of and modifications to the invention
10 can also take place without departing from the scope
of the appended claims.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A reciprocally operable fluid pump comprising an elongate tubular barrel housing having a lower fluid intake end part and an upper fluid discharge part, the lower intake end part being provided with a one way valve means permitting passage of fluid through at least one intake opening thereat to the interior of the barrel housing but preventing egress of fluid from such intake opening(s), and an elongate pump shaft arranged for location and longitudinal reciprocal movement within said barrel housing and having an upper end part arranged to project through and beyond a seal means at the barrel housing upper end to be subject to a reciprocal driving force in operation of the pump; the pump shaft being provided at an inner lower end thereof with a hollow piston assembly having a main piston part of complementary dimensions to the barrel housing bore for sliding seal engagement therein, said main piston part incorporating a one way valve means arranged to open and close at least one lower transfer opening communicating with the interior of the main piston part and a lower chamber defined between the barrel housing intake part and valve means and the piston assembly; the cross sectional dimensions of the pump shaft are such that an annular chamber is defined thereabout within the barrel housing between said piston assembly and a fluid discharge outlet at or near the upper end of the barrel housing, and an upper part of said piston assembly and/or an adjacent connection with the pump shaft defines a co-axial upper extension of the main piston part interior and is provided with at least one further fluid transfer port(s) communicating with said annular chamber; and

wherein said pump shaft has its inner lower end part coupled to an upper wall part of the piston assembly and defining a lower pump shaft chamber opening to a medial fluid transfer port in said piston assembly upper wall part, said pump shaft inner lower end part being provided with at least one further fluid transfer port opening to said lower pump shaft chamber to enable fluid forced through said piston assembly, the arrangement and construction providing that with the pump intake end part immersed in a fluid and the barrel housing fixed against movement, first upward movement of the pump shaft and connected piston assembly will draw fluid into the lower chamber via said intake opening(s) and one way valve means therefor, following downward reciprocal movement of the pump shaft and piston assembly causes and permits transfers of fluid from the lower chamber to said annular chamber via said piston assembly transfer opening(s) and port(s) and one way valve means, and following upward reciprocal movement of the pump shaft and piston assembly will force the fluid in the annular chamber to be discharged through the discharge outlet simultaneous with intake of fluid to the lower chamber.

2. A fluid pump as claimed in claim 1, wherein wherein said one way valve means at the lower intake end part of the tubular barrel housing is a ball valve means comprising a ball held captive between spaced lower wall and upper restrainer wall parts disposed transversely within the lower intake end part, the lower wall part being provided with one intake opening and with the inner periphery of said intake opening defining a valve seat on which the ball of the valve

means is sealably locatable to prevent egress of fluid from the pump via said intake opening; said upper restrainer wall part of the valve means being apertured and non-sealable to permit free fluid flow therethrough.

3. A fluid pump as claimed in claim 1 or claim 2, wherein said pump is arranged constructed and operable substantially as hereinbefore described with reference to the accompanying drawings.

DATED this 1st day of August 1997

ROBERT WILLIAM LUFF

By his Patent & Trade Mark Attorneys

CALLINAN LAWRIE



ABSTRACT

Summary of Invention

A reciprocally operable fluid pump with an elongate tubular barrel housing having a lower fluid intake end part and an upper fluid discharge part and outlet, the lower intake end part being provided with a one way valve means permitting passage of fluid through at least one intake opening thereat to the interior of the barrel housing but preventing egress of fluid from such intake opening(s), and an elongate pump shaft arranged for location and longitudinal reciprocal movement within said barrel housing and having an upper end part arranged to project through and beyond a seal means at the barrel housing upper end to be subject to a reciprocal driving force in operation of the pump; the pump shaft being provided at an inner lower end thereof with a hollow piston assembly for sliding seal engagement in the barrel housing and incorporating a one way valve means arranged to open and close at least one lower transfer opening communicating with a lower chamber defined between the barrel housing intake part and the piston assembly; said piston assembly and/or an adjacent connection with the pump shaft being provided with at least one further fluid transfer port(s) communicating with an annular chamber between the pump shaft and barrel housing, and the arrangement and construction providing that with the pump intake end part immersed in a fluid and the barrel housing fixed against movement, first upward movement of the pump shaft and connected piston assembly will draw fluid into the lower chamber, following downward reciprocal movement of the pump shaft and piston assembly causes and permits transfer of fluid from the lower chamber to the annular chamber via the piston assembly and following upward reciprocal movement of the pump shaft and piston assembly will force the fluid in the annular chamber to be discharged through the pump discharge outlet simultaneous with intake of fluid to the lower chamber.

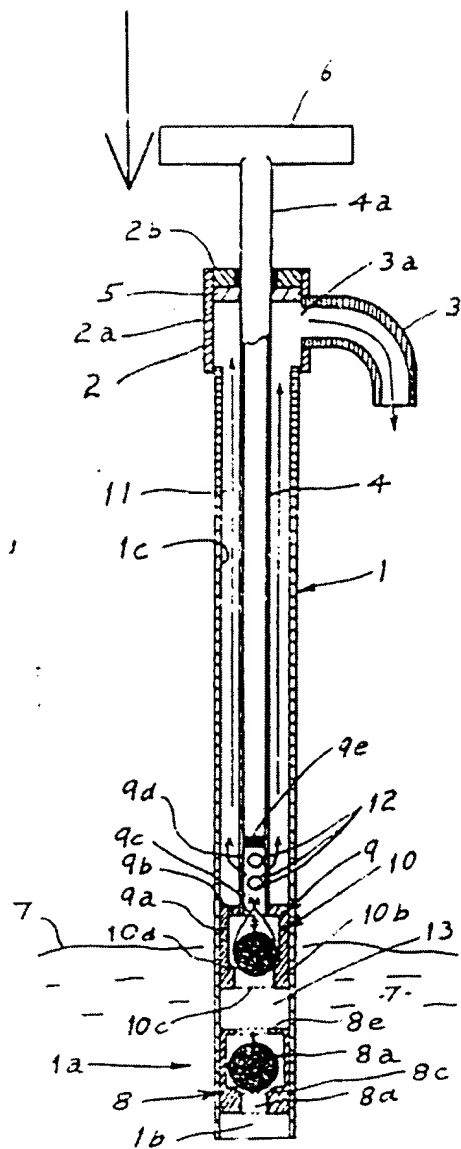


FIG 1

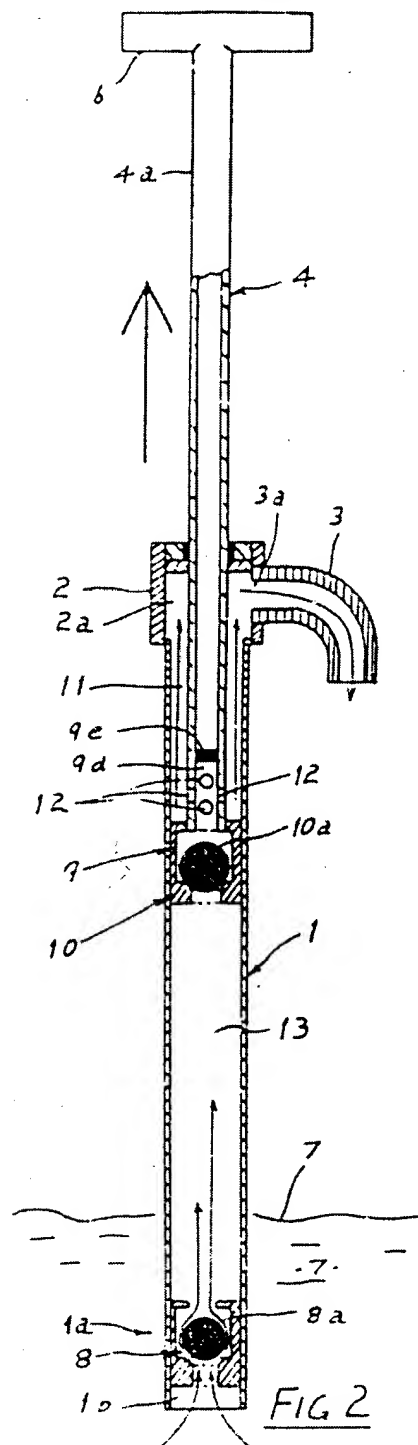


FIG 2

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